

A Hurricane Juliette Generated Coastally Trapped Wave In The HYbrid Coordinate Ocean Model (HYCOM)

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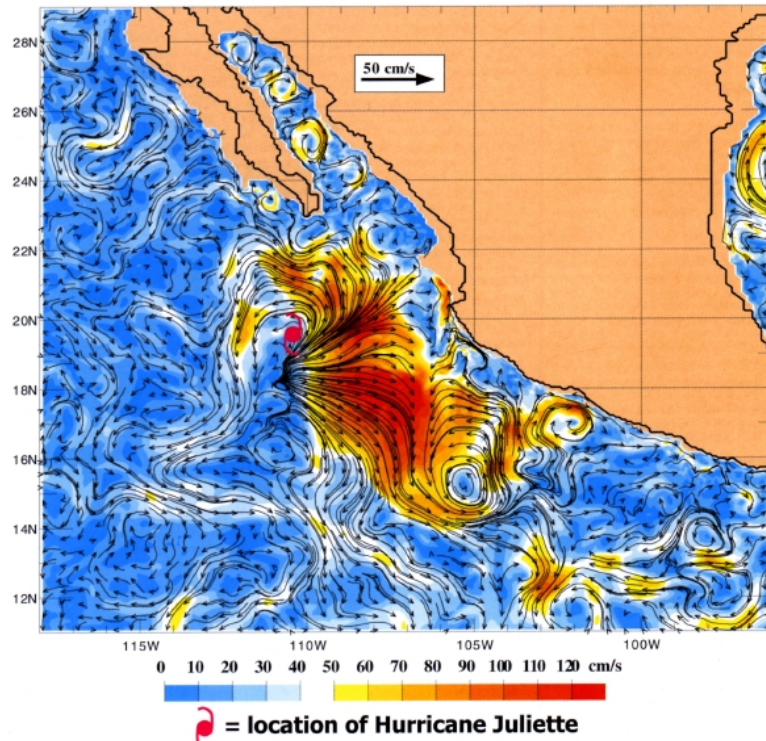
26-30 January 2004

Geophysical Research Letters

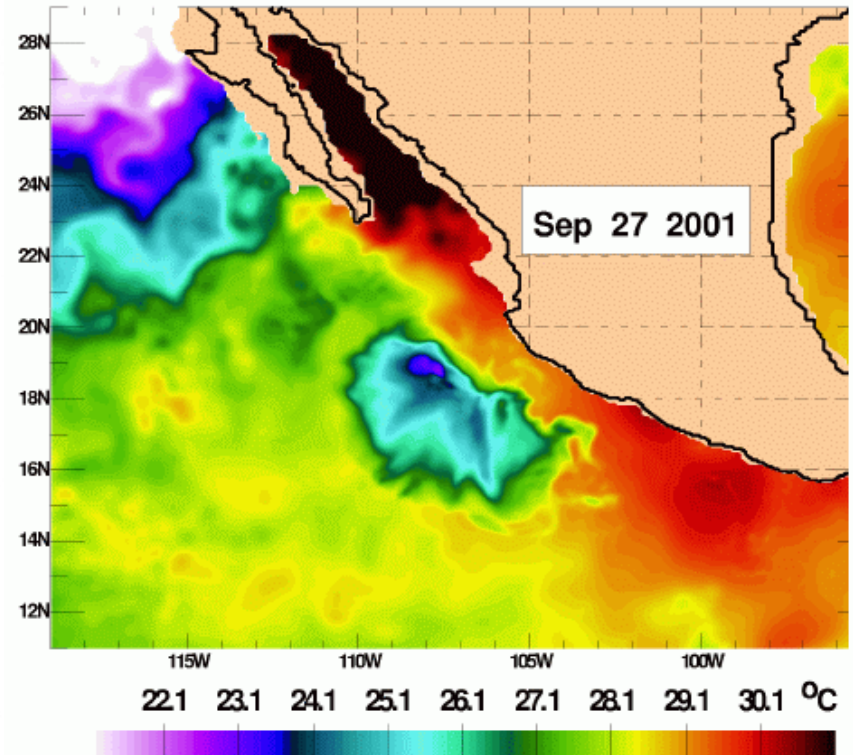
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Operational 1/16° global Navy Layered Ocean Model response to Hurricane Juliette

Upper Ocean Response to Hurricane Juliette



Sea Surface Temperature



Hurricanes are included in the
atmospheric forcing from FNMOC

Zamudio et al. (2002)

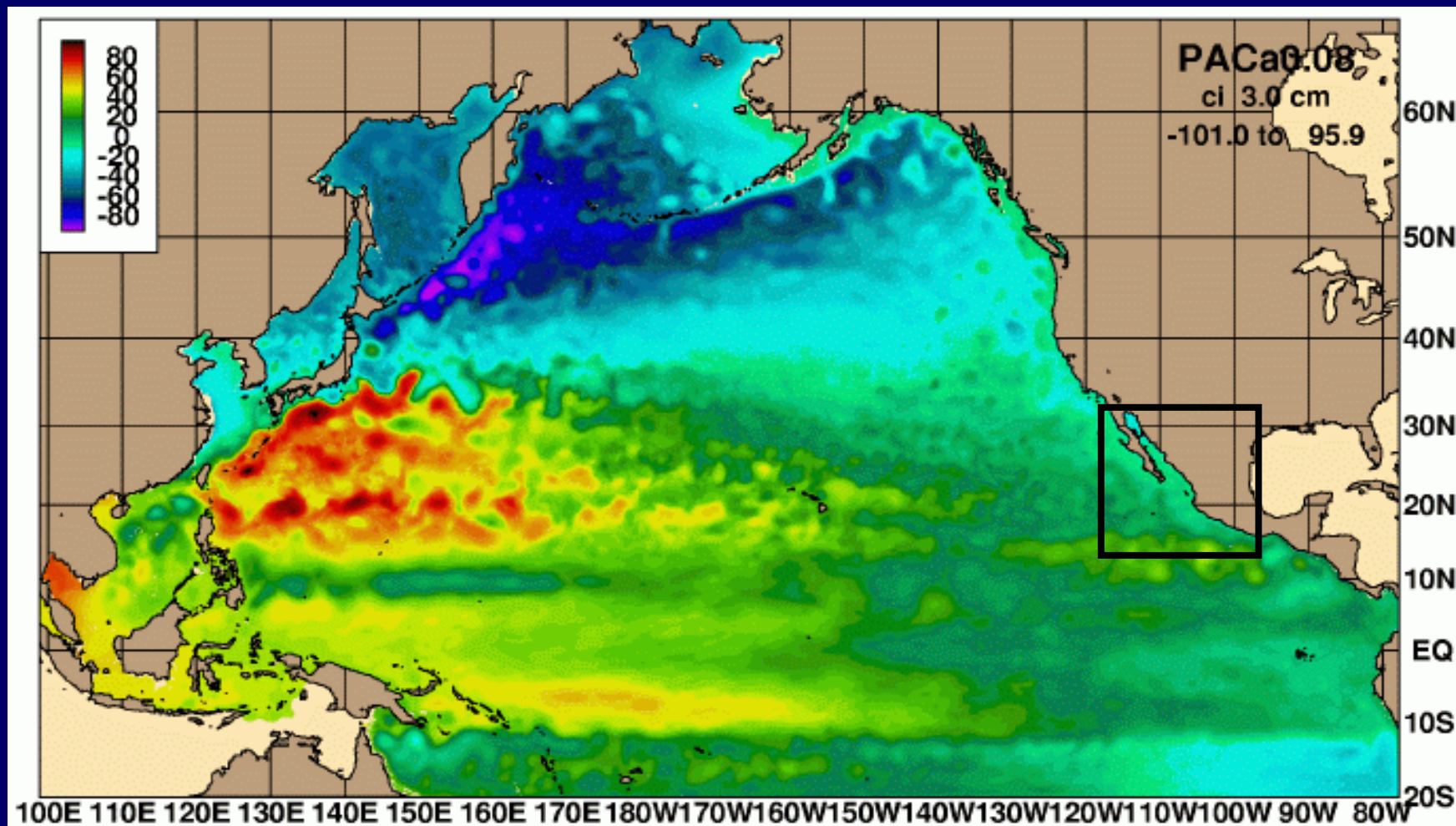
Tracking the evolution of "trapped waves" • Whaleborne sensors probing Arctic waters • Dust devils dumping dirt on Mars • Linking solar emissions and climate

HYCOM Configuration

- **2 Domains**
 - **Pacific basin:** 20°S - 62°N, 99°E - 78°W
 - **Gulf of California:** 14°N - 32°N, 118°W - 97°W
nested within Pacific HYCOM
- **3 Model resolutions**
 - Pacific basin: **1/12°**
 - Gulf of California: **1/25°** (2x), **1/37.5°** (3x)
- **20 vertical coordinate surfaces**
- **KPP mixed layer**
- **Surface forcing: wind stress, wind speed, thermal forcing, precipitation, relaxation to climatological SSS**
- **Monthly river runoff**

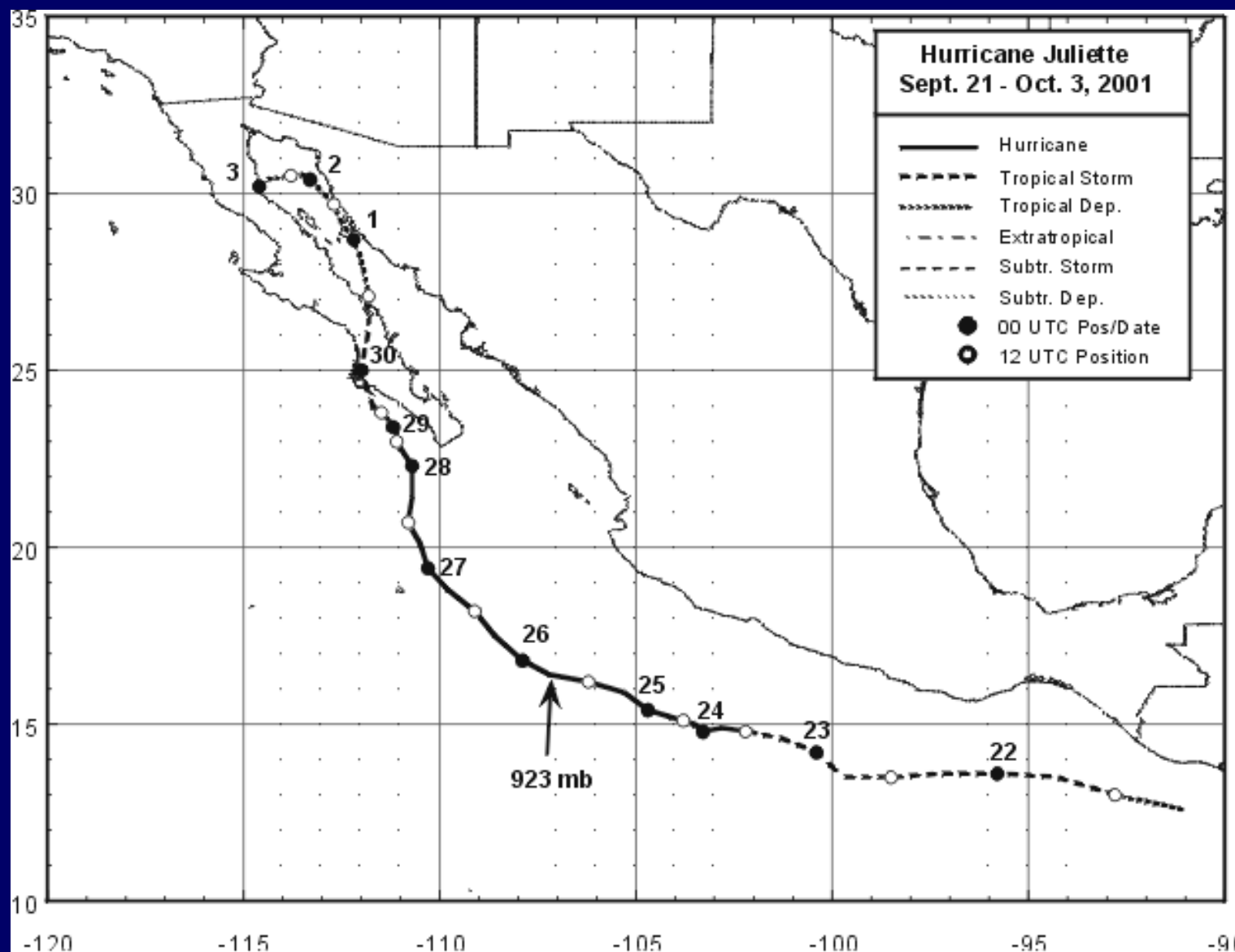
1/12° Pacific HYCOM Basin-scale Circulation

SSH Snapshot – 21 March



Nesting strategy: 1-day updating in a 10 gridpoint buffer zone at the GOC boundaries using T, S, P, u and v from the Pacific model

Track of Hurricane Juliette

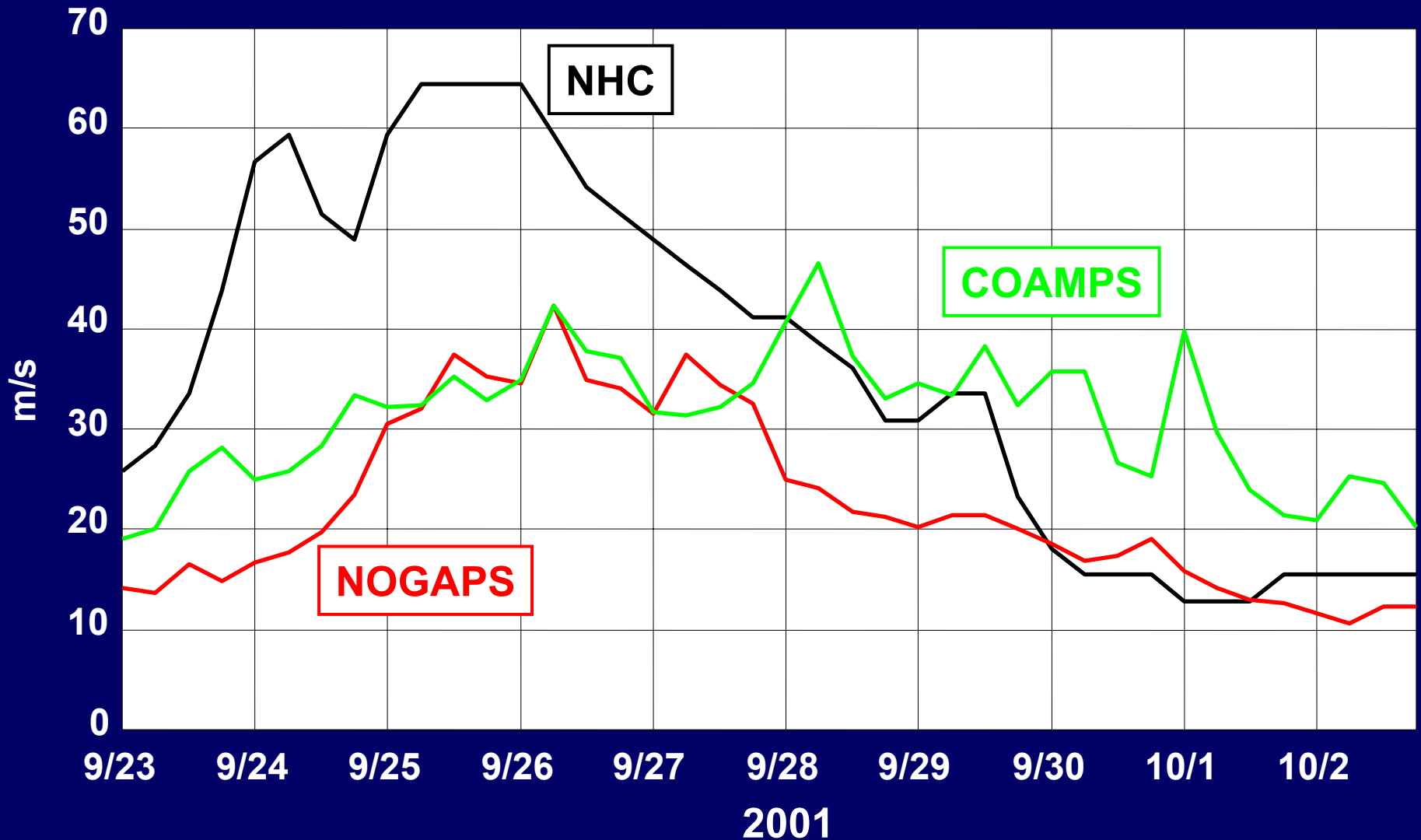


Source: National Hurricane Center

Atmospheric Forcing

- **Fleet Numerical Meteorology and Oceanography Center (FNMOC) wind forcing (6 hourly)**
 - 1° Navy Operational Global Atmospheric Prediction System (NOGAPS) surface stresses
 - 27 km Central America Coupled Ocean Atmosphere Prediction System (COAMPS) surface stresses
 - Domain: 0° - 32°N, 120°W - 60°W
- **FNMOC NOGAPS thermal forcing (6 hourly air temperature, specific humidity, shortwave and longwave radiation)**
- **FNMOC NOGAPS precipitation (6 hourly)**

Maximum Windspeed Associated With Hurricane Juliette



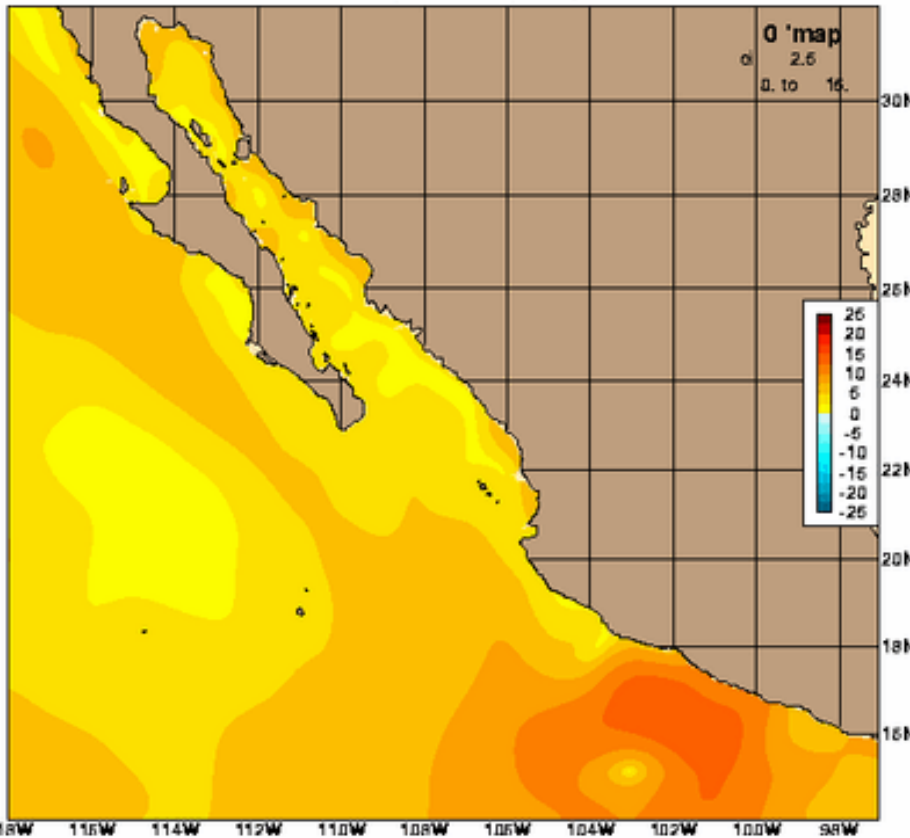
Windspeed

23 September 2001 18Z

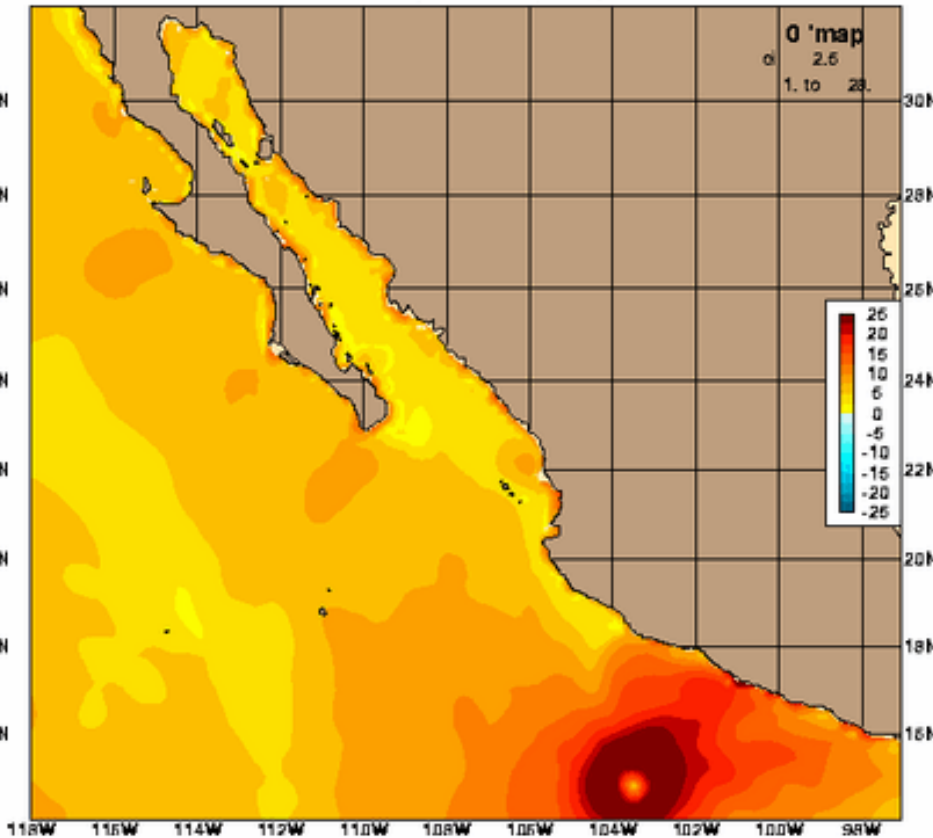
NOGAPS

COAMPS

NOGAPS Windspeed Sep 23, 2001 18Z



COAMPS Windspeed Sep 23, 2001 18Z



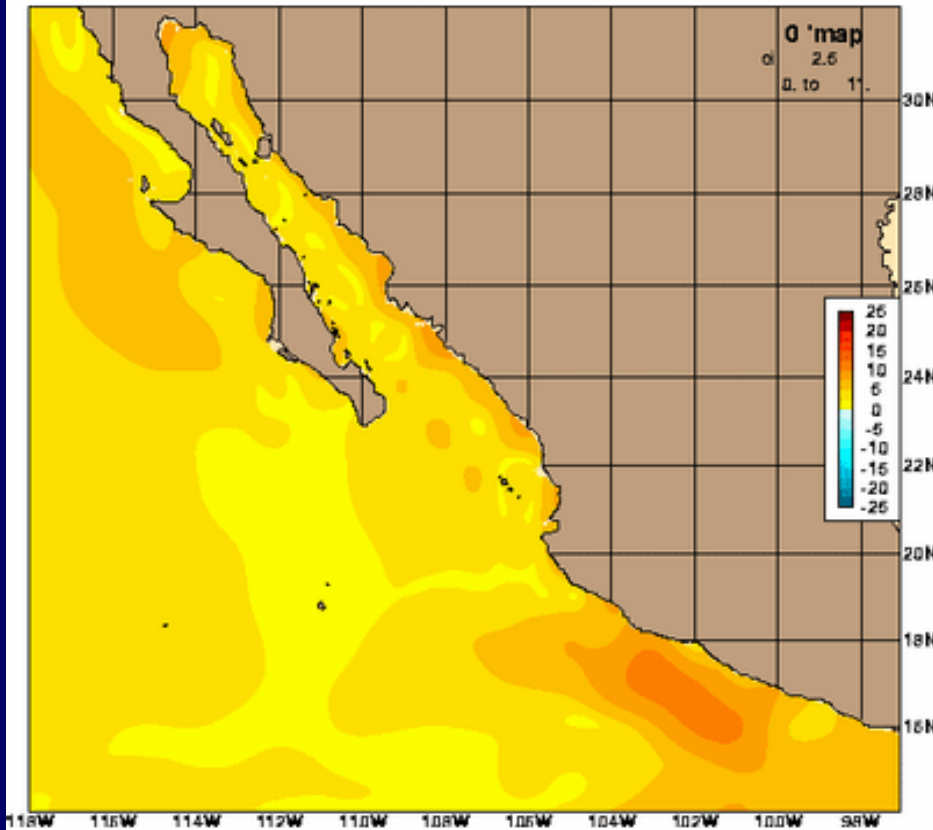
Note the much higher windspeed in the center of the storm as well as along the Mexican coast in COAMPS

Windspeed

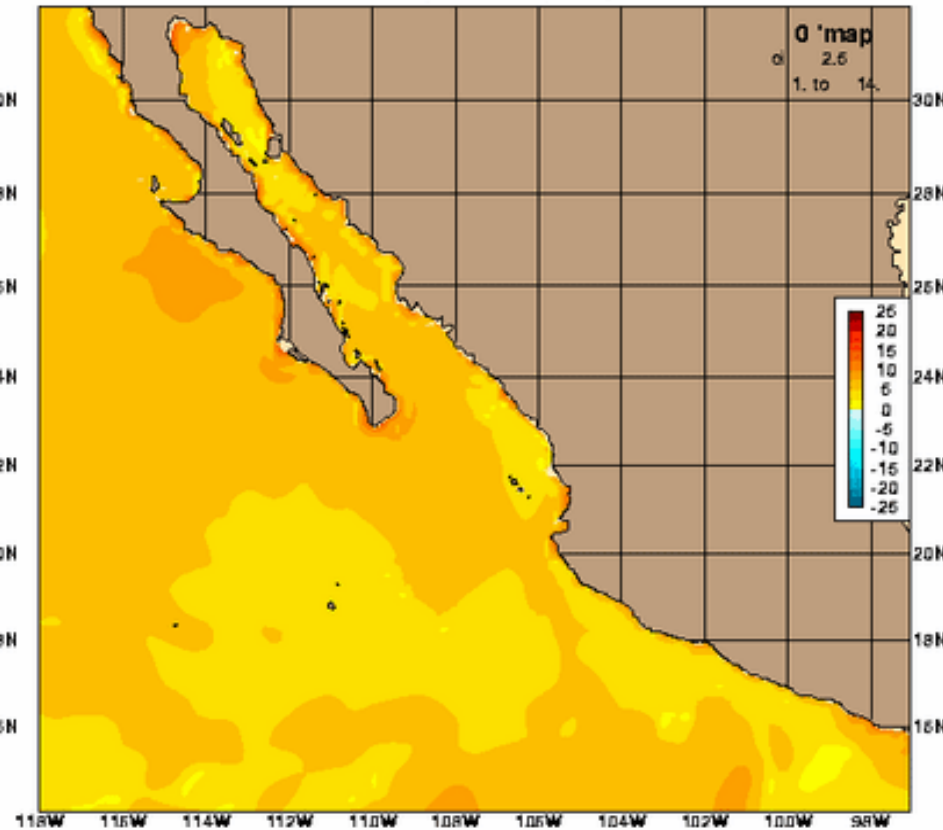
NOGAPS

COAMPS

NOGAPS Windspeed Sep 20, 2001 00Z



COAMPS Windspeed Sep 20, 2001 00Z



HYCOM Response to Hurricane Juliette

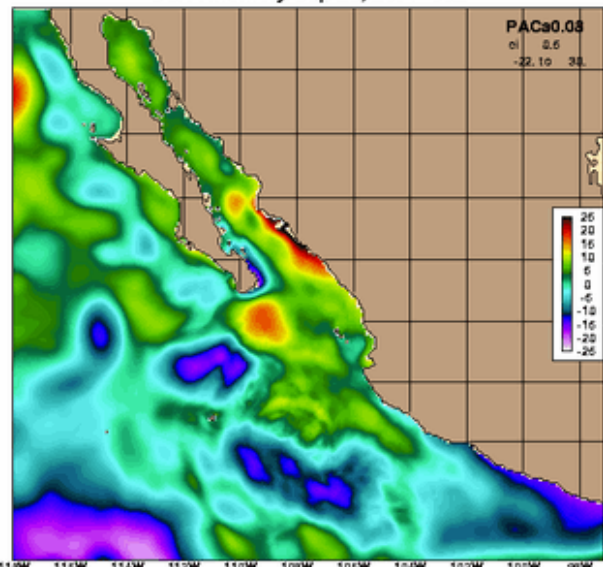
SSH anomaly – 29 September 2001 00Z

1/12° PAC

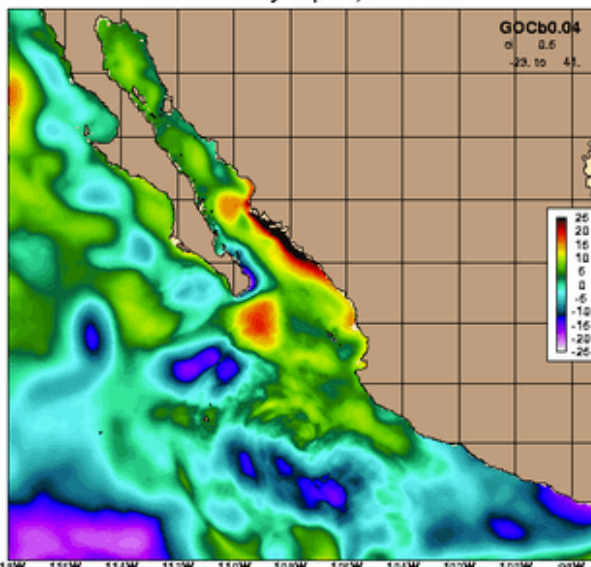
1/25° GOC

1/25° GOC

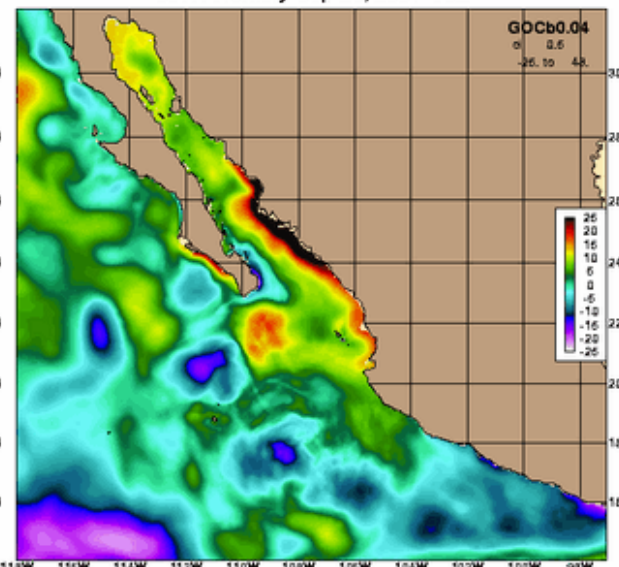
SSH Anomaly Sep 29, 2001 00Z



SSH Anomaly Sep 29, 2001 00Z



SSH Anomaly Sep 29, 2001 00Z



NOGAPS
wind forcing

NOGAPS
wind forcing

COAMPS
wind forcing

No data have been assimilated into the models

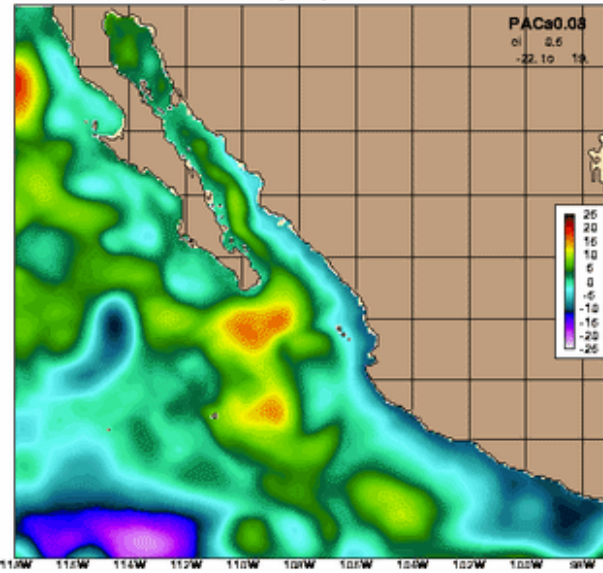
HYCOM Response to Hurricane Juliette

1/12° PAC

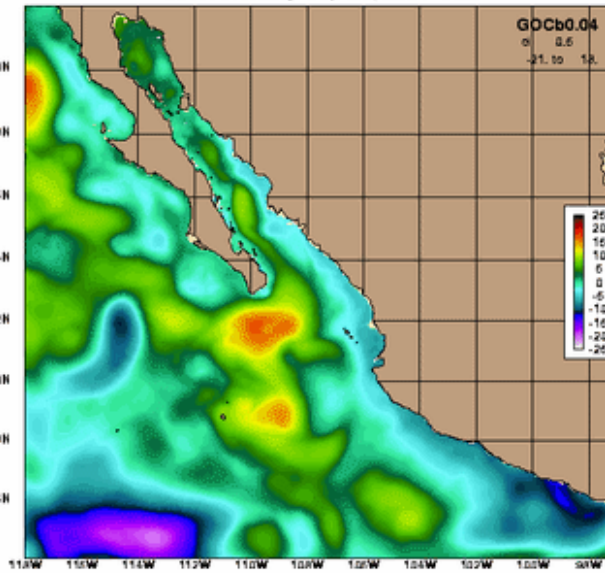
1/25° GOC

1/25° GOC

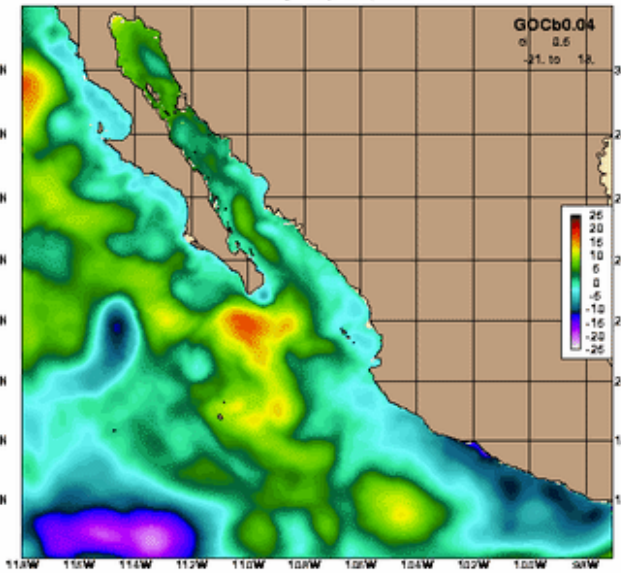
SSH Anomaly Sep 20, 2001 00Z



SSH Anomaly Sep 20, 2001 00Z



SSH Anomaly Sep 20, 2001 00Z



NOGAPS
wind forcing

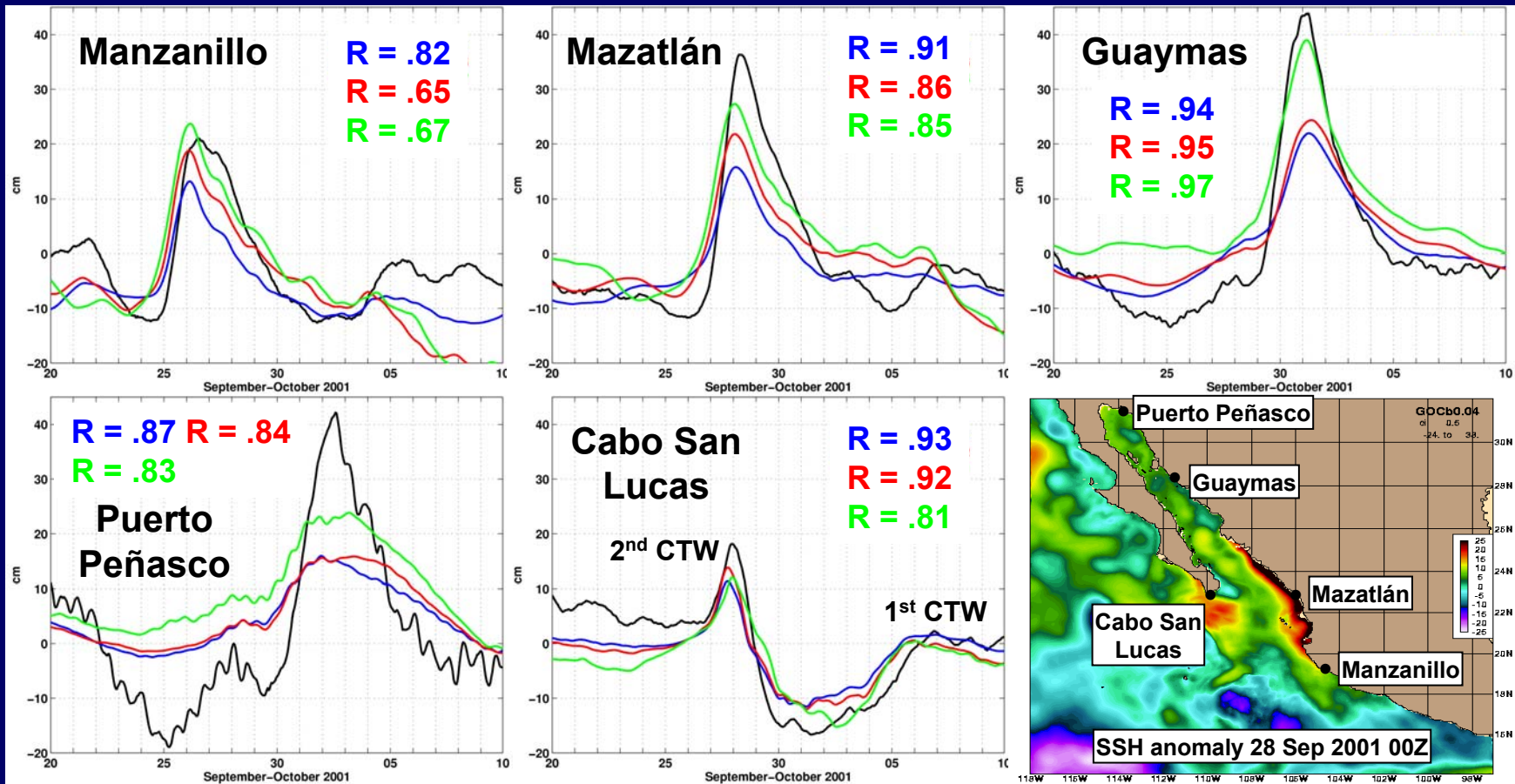
NOGAPS
wind forcing

COAMPS
wind forcing

No data have been assimilated into these models

Observed Versus Modeled Sea Level Anomaly Along the Mexican Coast Associated With the Coastally Trapped Waves (CTW) Generated by Hurricane Juliette: 20 Sept- 10 Oct 2001

Observations 1/12° Pacific 1/25° GOC – NOGAPS 1/25° GOC – COAMPS



A 1-day running mean filter has been applied to all time series. No data have been assimilated into the models. Observed sea level has been provided by the University of Hawaii and the Secretaría de Marina de México (Mexican Navy).

Summary

- CTW generated by Hurricane Juliette simulated by all versions of HYCOM
- Phase of the simulated CTW agrees well with observed sea level
- Amplitude of the simulated CTW is weakest in lowest resolution model ($1/12^\circ$) and increases with increasing model resolution ($1/25^\circ$)
- Amplitude of the simulated CTW is sensitive to the atmospheric forcing